REMARKS/ARGUMENTS

Status of the Claims

Claims 1-14, and 16-18 are pending in the application.

Claims 1, 11 and 12 are hereby amended to more clearly define the invention. New independent claim 18 has been added, which is a combination of the subject matter of claims 1 and 5. The amendments and remarks presented herein are fully supported by the application as originally filed. No new matter has been entered.

Claim Rejections – 35 USC s 103

With regard to claim 1, Examiner argues at page 11 lines 2-4 that Kosuge (US 6,571,196) discloses "the processing apparatus is arranged to adjust [t]he value of the offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point from the object plane". However, this feature is not present in claim 1. Applicant assumes from the Examiner's subsequent argument given in parenthesis that the Examiner intended to argue that the processing apparatus is arranged to adjust the value of the *object edge data component by an amount depending on the ratio of the size of the* offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point from the object plane. The Examiner argues that this feature is disclosed a col. 8 line 62-64 of Kosuge where it is taught that the XY stage moves the inspection object into a view field of the optical microscope.

Applicant respectfully disagrees. Firstly, this feature of claim 1 stipulates that the adjustment must be *"by an amount depending on the ratio of the size of the offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point from the object plane"*. Kosuge does not disclose an adjustment of this amount. Secondly, this

feature of claim 1 stipulates that it is the processing apparatus that performs this adjustment of the object edge data component, i.e. this feature is performed (by the processing apparatus) after an image has been captured. In contrast, moving the XY stage as taught by Kosuge is performed before an image is captured (see for example Kosuge col. 46-56). Therefore, Kosuge does not disclose this limitation of claim 1 since it does not disclose that the adjustment is by an amount depending on the size of the offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point from the object plane, or that the adjustment is performed by the processing apparatus on the object edge data component.

The Examiner has taken the position that, upon determining that an object edge data component is above the work surface, to adjust the value of the object edge data component by an amount depending on the size of the offset in a direction generally perpendicular with the work surface to the perpendicular distance of the camera's focal point from the object plane is nothing more than adjusting the field of view for the camera.

Applicant respectfully disagrees. In addition to the reasons stated above, the task of determining that an object edge data component is above the work surface can only be performed after an image has been captured. Adjusting the field of view for the camera must be done prior to image capture otherwise it can have no effect whatsoever on the captured data. Hence, it is impossible for adjusting the field of view for the camera to replicate a feature that includes making a determination that an object edge data component (which only exists after image capture) is above the work surface.

In connection with the foregoing, it is noted that the wording of claim 1 stipulates that the adjustment of the object edge data component by the processing apparatus is performed "*only in respect of object edge data components that are determined to relate to an upper edge of the object*". Hence, the adjustment of the object edge data component stipulated by claim 1 is only performed in relation to some of the object edge data components and it is impossible to do this

by adjusting the field of view for the camera since adjusting the field of view <u>must</u> affect all image data components.

The Examiner has taken the view that the offset is when the object is not located in the field of view of the camera, which would include being offset in the x, y, and z plane. However, the offset referred to in claim 1 is determined by the thickness of the object at the upper edge. In order to clarify this, and to further distinguish claim 1 over the Examiner's interpretation of the term "offset", claim 1 has been amended to remove the word "offset" when used as a noun and to instead define the ratio in terms of the thickness of the object at the upper edge.

Accordingly, claim 1 as amended now recites that "*only in respect of object edge data components that are determined to relate to an upper edge of the object the processing apparatus is arranged to adjust the value of the object edge data component by an amount depending on the ratio of the thickness of the object at said upper edge to the perpendicular distance of the camera's focal point from the object plane*". It is noted that Kosuge does not disclose this amended feature of claim 1 for the same reasons that are stated above, namely: Kosuge does not disclose "*an amount depending on the ratio of the thickness of the object at said upper edge to the perpendicular distance of the camera's focal point from the object plane*"; Kosuge does not disclose that the adjustment is performed by the processing apparatus; and movement of the XY stage to adjust the field of view cannot allow adjustment "*only in respect of object edge data components that are determined to relate to an upper edge of the object the processing apparatus*" since this can only be performed after the image has been captured and, even then, only on certain object edge data components, whereas in contrast, adjusting the field of view must be performed prior to image capture and must affect all of the image data.

Applicant agrees that Kosuge does not disclose an apparatus that determines whether each object edge data component relates to an edge of the object that lies on the work surface or to an edge

that is offset above the work surface; or that projects each image edge data component onto the object plane to produce a respective object edge data component in the object plane.

Examiner argues that Bachelder (US 5,974,169) discloses that the processing apparatus is arranged to project each image edge data component onto the object plane to produce a respective object edge data component in the object pane.

Applicant respectfully disagrees. Bachelder is concerned with determining the characteristics of an object represented in an image (col. 1, lines 7-9 and col. 2 lines 16-20) and discloses a method of identifying the boundaries of an object using bounding boxes (col. 2, lines 19-24). As can be seen from all of the relevant figures in Bachelder (i.e. Figures 3A to 3F, 4A to 4H and 5A to 5E and the accompanying description), Bachelder is concerned with identifying two dimensional boundaries in two dimensional image data. Therefore, Bachelder does not attempt to generate three dimensional data representing the object.

Accordingly, with respect to claim 1, Bachelder does not disclose projecting image edge data components onto the object plane to produce a respective object edge data component. This is because Bachelder does not attempt to generate three dimensional data representing the object and so has no need to do this. The passage of Bachelder referred to by the Examiner in this regard (col. 2, lines 26-29) discloses only a method of labelling boundary points, not projecting image data into the object plane.

Also, because Bachelder does not generate three dimensional data from the two dimensional image data, Bachelder does not disclose determining whether each object edge data component relates to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface by an amount substantially equal to a thickness of the object at said upper edge, as recited in claim 1. Instead, Bachelder only allocates boundary points to edges within a two dimensional space. The passage of Bachelder referred to by the

Examiner is this regard (col. 2, lines 15-34) only discloses that a boundary point falling outside a boundary box for a given edge is assumed not to form part of said given edge. Also this passage of Bachelder refers to a top or bottom edge of an object, it is an object <u>in a two dimensional image</u> and <u>not</u> the upper or lower edges of an object represented by three dimensional data as stipulated in claim 1.

Examiner argues that it would have been obvious to one skilled in the art to modify the apparatus of Kosuge with the technique disclosed in Bachelder. Applicant respectfully submits, however, that any such combination could not lead the skilled person toward the invention of claim 1 since, as set out above, Bachelder does not disclose any of the features of claim 1 that are missing from Kosuge. Moreover, Bachelder is solely concerned with determining the characteristics of an object represented in an image (col. 1, lines 7-9 and col. 2 lines 16-20) and as such is concerned with identifying <u>two dimensional boundaries in two dimensional image data</u> (see in particular Figures 3A to 3F, 4A to 4H and 5A to 5E and the accompanying description of Bachelder). This has nothing to do with generating three dimensional data representing the object (as stipulated in claim 1) and so could not lead the skilled person towards claim 1. Examiner argues that the skilled person would combine Bachelder with Kosuge to improve methods of determining characteristics of an object in an image. However, this has nothing to do with the invention of claim 1, which is concerned with generating three dimensional data representing the object from image data from a single image.

Applicant agrees with the Examiner that the combination of Kosuge and Bachelder is silent as regards a single image; and that the apparatus is arranged to receive the image data components from the camera and to generate, using image data components from a single image, three dimensional data representing at least part of the object, and wherein in order to generate said three dimensional data the apparatus is arranged to identify a plurality of said image data components that represent the position of a respective edge component of the object in an image plane.

Examiner argues that these features of claim 1 may be deduced from the Applicant's Admitted Prior Art (AAPA). Applicant respectfully disagrees. The AAPA mentions a telecentric lens or a line scan camera being used to generate 3D measurement data from a single image. However, a telecentric lens achieves this optically instead of by manipulation of the image data – it creates an image of the same size for objects at any distance and has a constant angle of view across its entire field of view. Accordingly, with a telecentric lens, there is no need to have a processing apparatus that generates three dimensional data from image data components from a single image as set out above. With regard to a line scan camera, this camera build up a digital image line-by-line by moving the object and camera relative to one another. At any given moment, the portion of the object being scanned is directly in line with the camera's line of sight. This means that the image data is always a true representation of the object and there is no need to have a processing apparatus that generates three dimensional data from image data components from a single image as set out above.

Examiner argues that it would have been obvious to one skilled in the art to modify the combined teachings of Kosuge and Bachelder with the AAPA. Applicant respectfully submits, however, that any such combination could not lead the skilled person toward the invention of claim 1 since, as set out above, the AAPA does not disclose any of the features of claim 1 that are missing from Kosuge and Bachelder.

Applicant agrees with the Examiner that Kosuge, Bachelder and AAPA together do not disclose that said object edge data components that are determined to relate to an upper edge of the object are adjusted with respect to the other object data components produced by said processing apparatus from said single image.

Examiner argues that this feature is disclosed by Buckley (US 6,064,759). Applicant respectfully disagrees. Buckley does disclose that actual measurements may be adjusted to

match a geometric model (col. 28, lines 22-28) and that this results in an accurate prediction by the geometric model of surface and edge locations of objects (col. 28, lines 28-30). However, Buckley does not disclose that object edge data components that are determined to relate to an upper edge of the object are adjusted with respect to the other object data components produced by said processing apparatus from said single image. The passages of Buckley do not disclose or suggest anywhere that the object edge data components that are determined to relate to an upper edge of the object are adjusted with respect to the other object data components.

Examiner argues that by incorporating the determining an upper edge from Bachelder with Buckley, this feature is disclosed. However, the relevant passage of Bachelder (col. 2, lines 15-34) refers to a top or bottom edge of an object in a two dimensional image and not the upper or lower edges of an object represented by three dimensional data as stipulated in claim 1. Bachelder's teaching is therefore technically incompatible with Buckley in this regard and does not, in any event, disclose object edge data components that are determined to relate to an upper edge of the object (where the object edge data components belong to three dimensional data as stipulated in claim 1).

Examiner argues further that it would have been obvious for one of ordinary skill to incorporate the teachings of Buckley with Kosuge (modified by Bachelder and AAPA) to arrive at the invention of claim 1. Applicant respectfully submits, however, that any such combination could not lead the skilled person toward the invention of claim 1 since, as set out above, Buckley does not disclose any of the features of claim 1 that are missing from Kosuge, Bachelder and the AAPA.

Examiner argues further that it would have been obvious for one of ordinary skill to incorporate the teachings of Buckley with Kosuge (modified by Bachelder and AAPA) to optimize the inspection process, to increase the speed and improve accuracy of the inspection. In this connection, Applicant agrees that the teaching of Buckley is intended to improve accuracy by

making adjustments to measured values to match a geometric model. However, this has nothing to do with the invention of claim 1. The feature of claim 1 that the Examiner argues is supplied by Buckley is concerned with adjusting upper edge object data components with respect to other object data components when creating three dimensional data representing the object to compensate for the effect that the thickness of the object has on the non-adjusted value. This has nothing to do with matching values to a geometric model.

With regard to the Examiner's assertion concerning well known prior art, Applicant assumes that the Examiner means that where an object is located on a work surface, its upper edge will be offset above the work surface by an amount equal to the thickness of the object at the upper edge. If so, then the Applicant agrees with the Examiner but cannot see how this feature provides efficient image processing as suggested by the Examiner.

In summary, Applicant respectfully submits that none of Kosuge, Bachelder, AAPA, Buckley or the Well Known Prior Art disclose, either individually or in combination the following features of claim 1:

> *the processing apparatus being arranged to project each image edge data component onto the object plane to produce a respective object edge data component in the object plane,*
>
> the processing apparatus being further arranged to determine whether each object edge data component relates to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface by an amount substantially equal to a thickness of the object at said upper edge,
>
> *and wherein, only in respect of object edge data components that are determined to relate to an upper edge of the object, the processing apparatus is arranged to adjust the value of the respective object edge data component by an amount depending on the ratio of the thickness*

of the object at said upper edge to the perpendicular distance of the camera's focal point from the object plane, such that said object edge data components that are determined to relate to an upper edge of the object are adjusted with respect to the other object data components produced by said processing apparatus from said single image.

It is therefore respectfully submitted that, since neither Kosuge, Bachelder, the AAPA, Buckley or the well known prior art disclose any of the features recited above, their combined teachings could not lead the skilled person to the invention of claim 1

Further, with regard to the question of obviousness, Bachelder relates purely to identification of two dimensional objects in two dimensional images and so its teaching is not relevant to, and is technically incompatible with, the generation of three dimensional data from a single image. The AAPA teaches the use of a telecentric lens or a line scan camera and so would lead the skilled person away from the invention of claim 1. Buckley discloses the use of multiple cameras and so would lead the skilled person away from claim 1.

Accordingly, Applicant respectfully submits that claim 1 is patentably distinguished over Kosuge, Bachelder, the AAPA, Buckley and the well known prior art.

Similar comments apply in relation to claims 12 and 13, which are of corresponding scope to claim 1.

With regard to claims 2 to 4, these claims depend from amended claim 1 and thus incorporate the same limitations of amended Claim 1 and are therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for at least the reasons set forth above.

More specifically, claims 2 to 4 define how the object edge data components that relate to upper or lower edges are adjusted in situations where an edge profile of the object is perpendicular to

the object plane or is undercut or beveled. Applicant respectfully disagrees with the Examiner that Kosuge discloses the features of claims 2 to 4. For the same reasons given above in relation to claim 1, adjusting the field of view of the camera, or moving the camera or the stage, cannot replicate the adjustment of object edge data components required by claims 2 to 4. Moreover, the specific amount of the adjustments given in claims 2 to 4 are not disclosed or suggested by Kosuge. With regard to the passage of Bachelder referred to by the Examiner in connection with claim 2 (col. 2, lines 15-24), as indicated above, Bachelder refers to a top or bottom edge of an object in a two dimensional image and not the upper or lower edges of an object represented by three dimensional data as required by claim 2. With regard to the passage of Bachelder referred to by the Examiner in connection with claims 3 and 4 (col. 4, lines 64-66), the polygonal shape taught by Bachelder is a two dimensional shape in a two dimensional image (Figures 3A to 3F, 4A to 4H and 5A to 5E and the accompanying description), whereas claims 2 to 4 relate to the edge profile of the object in a plane generally perpendicular to the object plane. Bachelder does not disclose an object plane.

Claims 5 to 8 and 11 recite how the processing apparatus may determine whether or not an object edge data component relates to an upper edge or a lower edge of the object. Before turning to the specific features of these claims, it may helpful to consider Figure 5 of the patent application as filed, which may provide a useful example of how the relevant features of claims 5 to 8 and 11 can be embodied. For convenience, a copy of Figure 5 is inserted below:

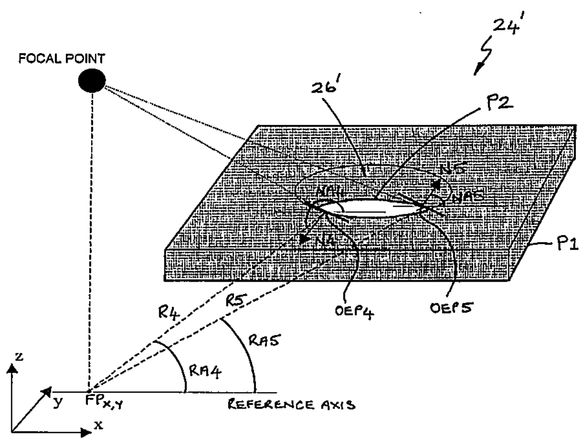

FIG.5

The following extract from page 16 line 23 to page 17 line 26 of the description may also be helpful:

"In Figure 5, there is shown a simplified object 24' under inspection. The object 24' has an aperture 26' formed therein. After block 208 (Figure 2), the object 24' is represented by two sets of OEPs, one set corresponding to the exterior perimeter of the object 24' (represented in Figure 5 as emboldened polyline P1), the other set corresponding to an interior perimeter (represented in Figure 5 as emboldened polyline P2) representing aperture 26'. For illustration purposes, two OEPS, namely OEP4 and OEP5 on interior polyline P2 are highlighted, the former being from the top edge of aperture 26', the latter being from the bottom edge aperture 26' (the relative terms "top" and "bottom" being taken with respect to the Z=0 plane and wherein increasing height is indicated by an increase in the value of the Z co-ordinate). The respective normals N4, N5 for OEP4 and OEP5 are shown extending outwardly from the polyline P2. The projected focal point of the camera 13 onto the Z=0 plane is shown as $FP_{x,y}$. The data processing module 16 notionally constructs a respective radial line R4, R5 (or a representation thereof) extending between the projected focal point $FP_{x,y}$ and OEP4, OEP5 respectively. In respect of each radial line R4, R5, the data processing module 16 calculates (block 212) a respective angle RA4, RA5 between the reference axis and the radial line (hereinafter referred to as the radial angle). The radial angles are readily calculated from the known 2D co-ordinates (in the X-Y plane) of the projected focal point $F_{x,y}$ and the respective OEP.

Then, at block 214, the data processing module 16 compares the respective normal angle NA4, NA5 with the respective radial angle RA4, RA5. If the absolute difference between respective normal and radial angles is less than 90 degrees (as is the case for RA5 and NA5) then the data processing module 16 determines that the OEP relates to a bottom edge (block 220). If the absolute difference between respective normal and radial angles is greater than 90 degrees (as is the case for RA4,

NA4) then the data processing module 16 determines that the OEP relates to a top edge (block 216). If the angle is deemed to be equal to 90 degrees, then an assumption can be made that the OEP relates to either the top edge or the bottom edge, as desired."

Turning now to Claim 5, this claim depends from amended claim 1 and thus incorporate the same limitations of amended Claim 1 and are therefore patentably distinguishable over Kosuge, Bachelder, and the AAPA for at least the reasons set forth above.

Specifically, Claim 5 includes the limitation "*...wherein the processing apparatus is arranged to determine whether said object edge data components relate to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface by an amount substantially equal to a thickness of the object at said upper edge by...*"

Applicant agrees with the Examiner that Kosuge does not disclose this feature. However, Applicant respectfully disagrees with the Examiner that Bachelder discloses this feature for the following reasons.

Firstly, Bachelder does not disclose "*object edge data components*" as per claim 5. From Claim 1, on which Claim 5 is dependent, the "*<u>object</u> edge data components*" are defined as being <u>image</u> edge data components that are projected "*onto the object plane to produce a respective object edge data component in the object plane*", where Claim 1 further states that the object plane is provided by the work surface, and that the image edge data components are taken from the single image captured by the camera. In addition, claim 1 states that this projection of image edge data components to object edge data components is performed in order to "*generate, using said image data components of said single image, three dimensional data representing at least part of the object*".

Hence, it can be seen that object edge data components are not the same as image edge data components. Rather, the object edge data components are image edge data components that have been projected into the object plane in order to generate three dimensional data representing at least part of the object.

In contrast, Bachelder's discloses only image edge data components (see for example col. 2 lines 16 to 23 where Bachelder states "...the invention..provides....a method of determining a characteristic....of an object in an image. The method includes finding points in the image on the boundary of the object. The method further includes identifying bounding boxes, or regions, in the image, that correspond to edges of the object. (emphasis added)"). This fact is well illustrated in all of the relevant figures in Bachelder (i.e. Figures 3A to 3F, 4A to 4H and 5A to 5E) and the accompanying descriptions, from which it is clear that Bachelder is concerned with identifying two dimensional boundaries in two dimensional image data. Therefore, Bachelder does not disclose "object edge data components" as recited in Claim 5 and in view of the limitations of Claim 1 on which Claim 5 depends.

Secondly, Bachelder does not disclose a processing apparatus that *"is arranged to determine whether said object edge data components relate to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface"* as per claim 5.

In contrast, Bachelder tries to determine whether a point in the image belongs to the top, bottom, left or right boundary of the object in the image (see Bachelder col. 2, lines 19 to 29). Crucially, because Bachelder is only working with the image edge data components (and not, as explained above image data components that have been projected into the object plane in order to generate three dimensional data representing at least part of the object), the object being inspected by Bachelder comprises two dimensional image edge data components. This can be seen from figures 3A to 3F and 4A to 4H of Bachelder, where the objects 62, 92, 98 are two dimensional

shapes in an image. Also, col. 4 lines 64 to 66 of Bachelder state that the invention is suitable for use in cases where the object is of "any polygonal shape such as triangular, pentagonal, octagonal etc.", i.e. two dimensional shapes.

As a result, Bachelder does not try to determine if a point lies on the work surface or is offset above the work surface because none of the boundary (edge) points of the object in Bachelder's image are referenced to the work surface. Instead, they are all treated as belonging to a two dimensional object in the image. So, when Bachelder teaches, at col. 2 lines 19 to 29, about "top", "bottom", "left" or "right" boundaries of the object, these labels all refer to the orientation of the object in the two dimensional image (for example as viewed in Figure 3A). Determining whether an object edge data component relates to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface is only relevant when attempting to generate three dimensional data representing the object, and this is something that Bachelder does not attempt to do. To put this another way, Bachelder is not concerned with creating three dimensional data representing an object from the two dimensional captured image data and so does not determine, or need to determine, whether or not an object edge data component relates to a lower edge of the object that lies on the work surface or an upper edge of the object that is offset above the work surface.

Thirdly, Bachelder does not disclose "*by an amount substantially equal to a thickness of the object at said upper edge*" as per claim 5. As set out above, Bachelder deals only with two dimensional objects in the image and so the objects 62, 92, 98 disclosed by Bachelder do not have a thickness.

In addition, Bachelder does not disclose the feature of Claim 5 whereby said processing apparatus is arranged to perform the determination between lower and upper edges "*by calculating a respective first parameter relating to a notional reference line extending from the respective object edge data component.*" This is because, as set out above, Bachelder deals

solely with image edge data components and does not generate object edge data components as defined in claim 5 (including the limitations of Claim 1). Accordingly, Bachelder does not disclose a reference line extending from the respective object edge data component or a first parameter relating to the reference line.

Further, Bachelder does not disclose the feature of Claim 5 whereby the determination between lower and upper edges performed by said processing apparatus further includes "*calculating a second parameter relating to a notional line extending between the respective object edge data component and a reference point in the object plane*". This is because, as set out above, Bachelder deals solely with image edge data components and does not generate object edge data components as defined in claim 5 (including the limitations of Claim 1). Also, Bachelder does not perform any calculations with reference to the object plane and, moreover, does not mention the object plane – all Bachelder's calculations are performed in the image plane (this can be seen from col. 2 lines 19 to 57 and from Figures 3A to 3F, 4A to 4H and 5A to 5E of Bachelder where the object and the bounding boxes are clearly described and shown as being in the image itself). It is clear from the limitations of Claim 5 imposed by Claim 1 that the image plane and the object plane are distinct from one another. Accordingly, Bachelder does not disclose a reference point in the object plane, or a line extending between the respective object edge data component and the reference point in the object plane.

In addition, Bachelder does not disclose the feature of Claim 5 whereby the determination between lower and upper edges performed by said processing apparatus further includes "*comparing the difference between said first parameter and said second parameter against a threshold value*". This is because, for the reasons set out above, Bachelder does not disclose first and second parameters as defined in Claim 5 and so does not disclose comparing their difference against a threshold value.

Examiner identifies col. 2 lines 15 to 34, col. 9 lines 51 to 53 and items 48 and 50 in Figure 2 as being the relevant portions of Bachelder. As set out above, the teaching of col. 2 lines 15 to 34 relates solely to determining characteristics of objects in an image and this is very different from determining whether or not an object edge data component (being part of three dimensional data representing the object as per Claim 5 (including the limitations of Claim 1) and not an object in an image) relates to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface.

With regard to col. 9 lines 51 to 53, Examiner points out that Bachelder discloses that the method can use optional steps to identify and discard categorized boundary points that are out of line with similarly situated points. However, this is not relevant to Claim 5 since Claim 5 does not involve discarding any data components, or determining whether any data components are in line with others. Instead Claim 5 involves determining whether the object edge data components relate to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface.

In this connection, a further difference between the referenced Bachelder method using boundary boxes and the subject matter of Claim 5 is noted: Bachelder does not try to determine if a boundary point is, say, a top edge point or a bottom edge point, it only determines if a boundary point is a top edge point or not, or if a boundary point is a bottom edge point or not. It does this by determining whether or not the point is inside the relevant boundary box. This is in contrast to the determination made in Claim 5 where it is decided whether the object edge data components relate to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface.

It is respectfully submitted that, for the reasons given above, Bachelder does not disclose any of the features of Claim 5. Accordingly, it is respectfully submitted that the teaching of Bachelder either on its own or in combination with Kosuge, the AAPA and / or Buckley does not disclose

or suggest the combination called for in Claim 5 and could not lead a skilled person to the subject matter of Claim 5.

Applicant respectfully submits therefore that Claim 5 is patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA.

Regarding Claim 6, the features of this claim are dependent on Claim 5. It is respectfully submitted that Claim 6 is therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for the reasons set forth above.

Further, with regard to the passage of Bachelder identified by the Examiner (columns 8, lines 32 to 46 in Figure 3E) in relation to Claim 6, this states clearly that Bachelder decides that a boundary point in the two dimensional image data corresponds to a top edge of the object simply by deciding whether or not it falls into a particular bounding box. This does not involve the notional reference lines, first and second parameters, and threshold values comparisons of Claim 5, or that the first parameter comprises the value of an angle between an angle reference axis and said notional reference line extending from the respective object edge data component as stipulated in Claim 6.

Regarding Claim 7, this claim is dependent on Claim 5. It is respectfully submitted that Claim 7 is therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for the reasons set forth above.

More specifically, the first passage of Bachelder identified by the Examiner (columns 8, lines 32 to 46 in Figure 3E by reference to the argumentation for Claim 6) in relation to Claim 7 states only that Bachelder decides that a boundary point in the two dimensional image data corresponds to a top edge of the object simply by deciding whether or not it falls into a particular bounding box. This passage of Bachelder does not disclose the notional reference lines, first and second

parameters, and threshold values comparisons of Claim 5, or that the second parameter comprises the value of an angle between an angle reference axis and said notional reference line extending between the object edge data component and said reference point as stipulated in Claim 7.

The Examiner also mentions steps 42, 44 and 46 of Figure 2 is relation to Claim 7, pointing out that Bachelder's method includes finding points in respective bounding boxes, comparing orientations of points with expected orientations and thus categorizing points as correlating with model or real world object. None of these features are present in Claim 7 or in Claim 5 from which it depends. Furthermore, this passage of Bachelder does not disclose the notional reference lines, first and second parameters, and threshold values comparisons of Claim 5, or that the second parameter comprises the value of an angle between an angle reference axis and said notional reference line extending between the object edge data component and said reference point as stipulated in Claim 7.

Regarding Claim 8, this claim is dependent on Claim 5. It is respectfully submitted that Claim 8 is therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for the reasons set forth above.

More specifically, the first passage of Bachelder identified by the Examiner (columns 8, lines 32 to 46 in Figure 3E by reference to the argumentation for Claims 6 and 7) does not disclose the notional reference lines, first and second parameters, and threshold values comparisons of Claim 5 or that said reference point on the object plane comprises the position of the camera's focal point in the object plane – it is noted in particular that the object plane and the camera's focal point are irrelevant to Bachelder since, as explained above, he is concerned exclusively with objects <u>in the image</u> and so does not mention the object plane or the camera's focal point in relation to his method. Nor does Bachelder disclose the notional reference line extending from

the respective object edge data component comprises a line normal to the object at said object edge data component, or that the threshold value is 90 degrees.

The Examiner also identifies col. 10 lines 19 to 36 and steps 36, 42, 44 and 46 of Figure 2 as being relevant to Claim 8. This relates to an alternative embodiment envisaged by Bachelder in which each boundary point is assigned an angle representing its orientation and these are compared to the expected orientations of the object edges in order to categorize the boundary points. As is described in more detail above, however, Bachelder's boundary points are in an object in an image and this is not relevant to determining whether or not an object edge data component (being part of three dimensional data representing the object as per Claim 5 (including the limitations of Claim 1) and not an object in an image) relates to a lower edge of the object that lies on the work surface or to an upper edge of the object that is offset above the work surface. Moreover, this passage of Bachelder does not disclose the notional reference lines, first and second parameters, and threshold values comparisons of Claim 5 or that said reference point on the object plane comprises the position of the camera's focal point in the object plane, or that the notional reference line extending from the respective object edge data component comprises a line normal to the object at said object edge data component, or that the threshold value is 90 degrees.

With reference to Claims 9 and 10, Claims 9 and 10 depend from amended Claim 1 and are therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for at least the reasons set forth above.

With regard to Claim 11, this is an independent claim directed towards the processing apparatus for use in the system of claim 1, and is further limited by all of the features of claim 5. Accordingly, Claim 11 is respectfully submitted as being patentable over Kosuge, Bachelder, Buckley and the AAPA for the reasons given previously in relation to Claims 1 and the reasons set forth above in relation to Claim 5.

Claim 14 depends from amended Claim 1 and are therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for at least the reasons set forth above in reference to Claim 1.

With regard to claim 16, the features of this claim are dependent on Claim 5. Claim 16 is therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for at least the reasons set forth above in relation to claim 5.

With regard to the features of claim 16, as set out above Bachelder only refers to a top or bottom edge of an object <u>in a two dimensional image</u> and <u>not</u> the upper or lower edges of an object represented by three dimensional data as required by claim 16 (when its dependency is taken into account). Nishiwaki (US 2002/0172422) discloses, at paragraph [0051], that the inside edges of character frames are detected. Neither Nishiwaki nor Bachelder disclose that object edge data points are arranged in sets in which each object edge data point in a respective set represents a common interior or exterior perimeter, and wherein the processing apparatus determines whether at least one object edge data component in each set relates to a lower edge of the object or to an upper edge of the object.

Therefore, since Nishiwaki and Bachelder do not disclose either individually or in combination the features of claim 16, they could not lead a skilled person to the subject matter of this claim. Further, both Nishiwaki and Bachelder relate to examining features of two dimensional images and so are not relevant to the invention of claim 1, which is concerned with generating three dimensional data representing the object from image data from a single image.

With regard to claim 17, the features of this claim are dependent on Claim 11. Claim 17 is therefore patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for at least

the reasons set forth above in relation to claim 11. With regard to the features of claim 17, these are the same as for claim 16 and so the same comments apply.

With regard to new independent claim 18, this claim is a combination of claims 1 and 5 and is respectfully submitted as being patentably distinguishable over Kosuge, Bachelder, Buckley and the AAPA for the reasons given above in relation to claims 1 and 5.

Applicant respectfully requests reconsideration of the present application and respectfully solicits a Notice of Allowance of all claims.

Should the Examiner have any questions or suggestions, she is invited to contact the undersigned at (616) 975-5506 or at collins@vglb.com.

Respectfully submitted,

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